

Packaging and Manufacturing Processes to Enable Production of Very Large Solar Sails for Next Generation Missions, Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

NASA's Near Earth Asteroid Scout (NEAS) mission incorporates the current state of the art in solar sail packaging, fabrication, and testing. In early 2018, NeXolve will complete design, fabrication, ground deployment testing, packaging, and delivery of the 100m² class NEAS sail to NASA MSFC.

The current approach used for NEAS packaging has practical limits with regard to scalability to larger sails and the ability to support much needed reliable and repeatable ground deployment testing at the NEAS scale. The efficiency and reliability of packaging processes also pose technical and schedule risk to the sail program. The current NEAS sail packaging processes are labor intensive, time consuming, have implicit risk to the sail due to extensive handling, and are not considered scalable beyond the NEAS class sail.

The proposed innovative packaging processes and mechanisms will address the limits encountered by the current NEAS processes and mechanisms. The proposed innovations improve packaging quality and efficiency by:

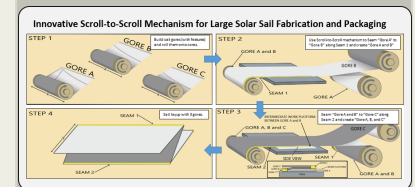
- Maintain high specular surface integrity
- Reduce risk of entanglement, "blossoming", creasing, stacking, or "sticksion".
- Reduce sail damage (tears)
- Reduce flight packaging cycle duration
- Enabling multiple ground tests cycles
- Provide reliable and scalable options for larger 1000m² class sails

The proposed technology development includes development of mechanical folding aids and mechanisms that will provide reliable and repeatable folding a storage of very thin ethereal sail materials that are very difficult to package using state of the art manual labor intensive process. The project also addresses issues of scalability by developing methods for fabricating sales in-situ with the packaging process. Thus enabling fabrication and packaging of Sails too large to be laid out flat and folded using current state of the art methods.

Anticipated Benefits

The proposed technology will improve reliability and testability of sails in current CubeSat class (NEA Scout, Nanosail). However, the largest payoff of this technology will be realized by developing a feasible method for packaging and deploying much larger solar sails (1000+ Sq. Meters) for future high value missions such as Geo-Storm, pole sitters, inter-stellar missions and other proposed sail applications.

There are many applications where larger continuous films would improve current practices. For example seamless protective covers for aircraft, large structures and agriculture. The technology developed in this activity is generic



Packaging and Manufacturing Processes to Enable Production of Very Large Solar Sails for Next Generation Missions, Phase I

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

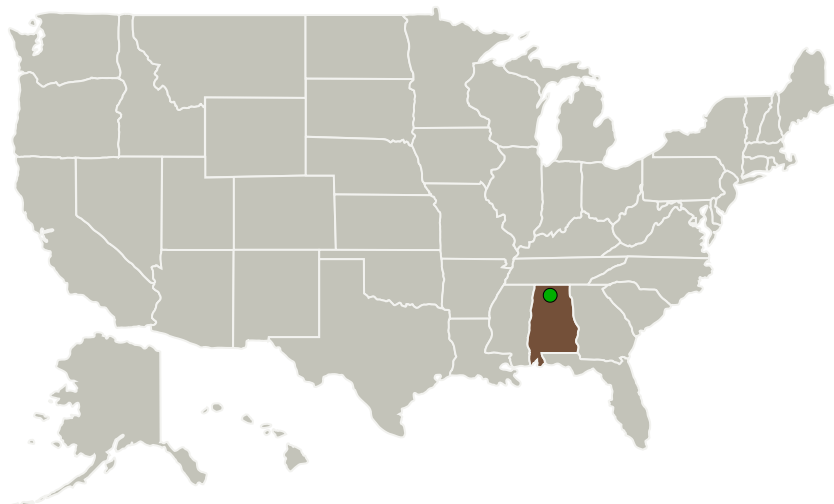
Packaging and Manufacturing Processes to Enable Production of Very Large Solar Sails for Next Generation Missions, Phase I

Completed Technology Project (2018 - 2019)



and can be applied to fabrication of many different types of thin flexible materials such as polymers, fabrics, and foils.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Nexolve Corporation	Lead Organization	Industry	Huntsville, Alabama
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama

Project Transitions

▶ **July 2018:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nexolve Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

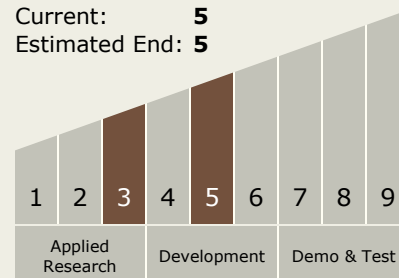
Carlos Torrez

Principal Investigator:

James Pearson

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Packaging and Manufacturing Processes to Enable Production of Very Large Solar Sails for Next Generation Missions, Phase I

Completed Technology Project (2018 - 2019)

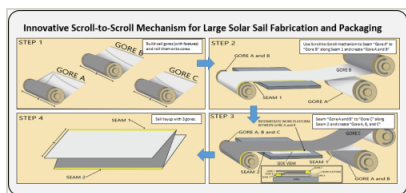


February 2019: Closed out

Closeout Documentation:

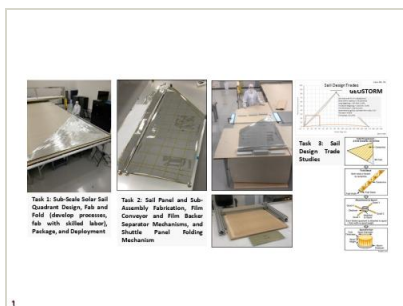
- Final Summary Chart(<https://techport.nasa.gov/file/141223>)

Images



Briefing Chart Image

Packaging and Manufacturing Processes to Enable Production of Very Large Solar Sails for Next Generation Missions, Phase I (<https://techport.nasa.gov/image/133538>)



Final Summary Chart Image

Packaging and Manufacturing Processes to Enable Production of Very Large Solar Sails for Next Generation Missions, Phase I (<https://techport.nasa.gov/image/136427>)

Technology Areas

Primary:

- TX01 Propulsion Systems
 - TX01.4 Advanced Propulsion
 - TX01.4.1 Solar Sails

Target Destinations

Mars, Others Inside the Solar System